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# XXIII.

## MINERALOGICAL OBSERVATIONS, MADE IN THE ENVIRONS OF BOSTON, IN THE YEARS 1807 AND 1808.

*Inclosed with a letter to the Hon. John Davis, Esq. F. A. A. and by him communicated.*

By S. GODON, F. A. A.

### *Introduction.*

A KNOWLEDGE of the physical objects, which compose the mineral riches of a country, is so much connected with the well-being of the people, who live in it, that we cannot reflect, without amazement, on the inattention to this study, which so long prevailed among nations in general. It is but a few years since men have begun to perceive its importance, and its connexion with public and private utility.

One of the most happy results of the improvement of natural history at the end of the last century is, undoubtedly, its procuring to the present age the way of discriminating and describing minerals with exactness and perspicuity ; so that a mineralogical description may circulate and be understood in the several parts of the world, where the language of natural sciences has penetrated. And while the present generation enjoys the labours of the modern naturalists, we indulge the comfortable hope, that the fruits of our own observations will not be lost to posterity.

Few publications of this description have been yet attempted, and these have been almost entirely limited to Europe. It is to be expected, that the example, given by this part of the world, will be followed by every other enlightened people, who may begin to perceive the great interest they have in the investigation of their soil. These local observations become even worthy of general attention, when we consider, that from the insulated descriptions of several parts of the earth we may expect in time an universal mineralogical map, which will afford in some measure, under a single point of view, a representation of all the riches in the world.

The observations, which I now present, are the sketch of a mineralogical description of the country, which surrounds Boston, to which a too short stay in that part of the United States prevented me from putting the finishing hand. I offer them to you in their state of imperfection with the hope, that they will be completed by some of your fellow citizens, whose increasing taste for mineralogy presages to the people of Massachusetts a flourishing period for this science.

The result of my observations, and the wish of communicating them in the most brief and plain manner, have induced me to make a slight alteration in the nomenclature of some rocks. I consider the principal aggregate mineral, as a distinct *genus*, which should have a single name, to which may be added a *specific* one, taken from the accidental occurrence of some element, or from some striking property. This binary denomination, which prevents troublesome periphrasis, agrees with the basis of general nomenclature, established in natural history.

These changes are limited to the rocks, described in the following dissertation ; and I present them to those, who are dedicated to mineralogical meditations, as an essay of a reformation, which observations, made in this vast continent, appear to render necessary in the nomenclature of the rocks, which compose the primordial soil, and even which form the whole series of the geognosical table.

—Si quid novisti rectius istis,
Candidus imperti ; si non, his utere mecum.

## *Definitions and preliminary explanations.*

*Primordial soil.* I call primordial, that part of the surface of the earth, formed of some of those simple or aggregate mineral masses, commonly called *rocks*, which have never been found containing *remnants of organized bodies*, and which are supposed to have been preexistent to the formation of animals and vegetables. I take this definition in its most extensive sense, without admitting any gradation in antiquity, among primordial rocks, for fear of bending my observations to some systematic opinion.

*Amphiboloid.* (Amphibolic rock, Haüy; Grünstein, Graustein, Werner.)

An aggregation, most frequently of amphibole and felspar, admitting in its composition quartz, epidote, talc, mica, and almost always sulphurated iron. Amphibole, which characterises this rock, is supposed to be the predominant substance. When the felspar is in greatest proportion, it takes the name of *felsparoid.*

*Felsparoid.* (Felspathic rock, Ha.; Syenite, Wer.)

An aggregation of felspar and amphibole; sometimes of felspar quartz, amphibole; also epidote and mica. When the felspar loses its laminary aspect, and assumes a compact texture, the rock takes the name of *petrosilex.*

*Petrosilex.* (Petrosilex and compact felspar, Ha.; Lametherie, uncertain among other mineralogists.)

A rock, homogeneous, or apparently so, of a splintery and semiconchoidal fracture, sparkling most frequently with steel, and of a great variety of colours. It often includes small crystalline particles of felspar, quartz, epidote, and even metallic substances. *Fusibility* before the blowpipe is the characteristic of this rock. When destitute of fusibility, it belongs to opaque-compact quartz (Hornstein of the Germans.)

When crystals of felspar exist in it, in notable proportion, it takes the specific designation of *porbhyritic*. The denomination of porphyry, being relative to an accidental disposition of elements, is reduced to a specific name.

### *Argilloid.* (Thonschiefer, Wer.)

It has a degree of softness, which permits it to be deeply scratched by the knife, complete opacity, and an argillaceous smell, when breathed on. It presents, as well as petrosilex, a great diversity of colours, and has most frequently a foliated texture. Petrosilex and argilloid unite by an insensible transition.

### *Wacke.* (Wern.)

A conglutination of orbicular, elliptical, and sometimes angular kernels or nodules of all sizes, commonly of the same nature as the primordial rocks above mentioned, particularly felsparoid, petrosilex, argilloid, and quartz.

### *Amygdaloid.* (Mandelstein, Wern.)

Round or elliptical kernels of felspar, carbonated lime, quartz, epidote, united together by a cement, apparently homogeneous to the sight.

Note.—I have placed between parentheses the name of the town, where the observation is made.

The sign ▭ indicates that the mineral is found in place.

The sign ○ indicates that it is found in loose fragments.

The numbers, in the table, refer to the corresponding numbers of the different paragraphs of the geognostic description.

For the simple minerals, I have adopted the nomenclature of Haüy ; but, for greater clearness, I add, to each species, a synonym, either vulgar, or adopted from some known author. The word *species* must not be taken in too rigorous a sense, particularly with regard to rocks. The divisions established, among natural beings, exist not in nature ; and are merely intended to facili tate their study, or to simplify the language.

* * *

### *Vegetable earth. Alluvial deposits. Waters.*

1. Some alluvial deposits, and the stratum, often light, of vegetable earth, excepted, the environs of Boston, and even the greater part of Massachusetts, present, almost every where, the primordial soil to the sight. The country is not mountainous, but its surface is largely and often deeply undulated. The springs, which arise from the most elevated part of the ground, often unite in basons, sometimes surrounded by hills, and form a multitude of ponds, which contribute to the embellishment of the landscape. The natural irrigation, which originates from the even disposition of the ground, maintains a constant moistness, which renders the land fertile and fit for several kinds of culture.

2. The alluvial deposits are commonly formed of a coarse quartzose sand, often mixed with a proportion of clay sufficient to permit their being made directly into bricks. They include, almost always, a great quantity of fragments of rocks, the nature of which indicates their origin from the great masses, which form the frame of the country we are describing. These alluvial heaps repose sometimes on a stratum of blue clay [Charlestown] impregnated with the oxyds of iron and manganese.

The proportion of clay, which forms a part, often considerable, of all the alluvial ground, on which rest almost all the buildings of the town of Boston, is a happy circumstance, which prevents the infiltration of sea-water, and which thus permits our obtaining, at a very short distance from the harbour, and even from under the sea itself, fresh and sweet water.

3. The waters, which flow under the ground, or which issue in springs at its surface, are frequently impregnated with foreign principles. These are principally *carbonic acid, carbonated lime* and *iron, sulphated magnesia*, and sometimes *muriated lime* and *magnesia.*

### *Amphiboloid.*

4. In a western direction from Boston, the rock, which occurs first, is amphiboloid, which passes frequently to felsparoid, and sometimes so abruptly, that it is very easy to get them both united in the same specimen. These two rocks, which always alternate, appear predominant in the northern as well as western part of Massachusetts. They appear in some islands of the harbour [outward Brewster], and are directed, even under the enclosure of the town of Boston, where they break through the mossy ground of the common.

5. Amphiboloid is very variable in its aspect, and in the proportion and disposition of its constituent principles. Amphibole, which is considered as its base, is commonly dark-greenish, grey, or black, of great intensity, frequently with a lamellated texture. The rock appears sometimes consisting of this substance alone, of an uniform colour, or intermixed with light spots or veins of white and rosy felspar, and magnetic sulphurated iron [Waltham]. I then call it *common amphiboloid.*

The two elements are frequently fitted together in such a manner, as to present irregular black and white spots. The felspar is commonly white, with a shade somewhat greasy, but preserving, almost always, its laminary texture. [Menotomy ▭, Waltham ▭]. The external part of this rock, long exposed to the air, presents the felspar in a state of decomposition; but, when fresh broken, it shows great compactness, and even lustre. It is susceptible of a good polish, and may be considered as perfectly analogous to the black granite of the ancients, (*granito nero*, of the Italians). I think proper to give it the name of *granitic amphiboloid.*

7. The two elements, which compose the preceding species, are sometimes promiscuously blended together, in particles so fine and imperceptible, as hardly to permit the magnifying glass to evidence that it is a compound mineral. [Brookline ○, Concord turnpike ▭]. This rock, which is an instance of the aggregation of two single minerals in a kind of moleculary state, breaks commonly into acute angular fragments, sometimes prismatic. On account of the resemblance of this aggregate with the Trapp of the Swedes, I give it the name of *Trappine Amphiboloid.*

8. Amphiboloid, considered as of an uniform colour, often includes crystal and felspar, presenting white parallelopipeds imbedded in a dark field. This variety, found contiguous to the preceding, [Lynn ▭] is ranked under the generic title of amphiboloid, with the specific name of *porphyritic.*

Porphyritic amphiboloid is frequently mixed with sulphurated iron (common pyrites).

9. A feature, which seems characteristic of the amphiboloid and felsparoid of this country, is their being frequently intercepted by veins of a substance, generally of a compact texture, and of a green colour, of various degrees of intensity. The thickness of these veins varies, from that of a sheet of paper, to two, three, or more inches. The characters, derived from the external appearance, and even those

from the chemical nature, of an earthy mineral, in an amorphous state, being insufficient to ascertain, decisively, to what species it corresponds, I remained long uncertain of the nature of this mineral; till, at length, some crystals of well characterised *epidote*, found in a small cavity of a vein of this substance, dispelled all my doubts on the subject. Soon afterward, an attentive examination of several amphiboloids demonstrated to me, that they admitted in their composition, epidote, sometimes even in a great proportion. This observation justifies the importance attributed, by Haüy, to the character of the crystalline form.

From the concurrence of epidote, among the other elements of amphiboloid, originates a rock, of a fine dark green colour, susceptible of a good polish, and which, at first sight, may be confounded with some variety of serpentine. When the elements are so entwined together, as to present a colour almost uniform, it may be considered as analogous to the rock, called *Egyptian basalt* by antiquaries, which was employed by the ancients in making figures and busts, several of which are seen in collections of the antiquities of Italy. But, commonly it consists of small acicular crystals of amphibole, imbedded in a kind of cement, composed of felspar and epidote. Some specimens present those three substances in distinct and separate state, like the elements of the granite.

This rock, which I denote by the name of *epidotic amphiboloid*, does not form so extensive masses, as the preceding species. It is found contiguous to felspar [Brighton ▭]; or in the form of veins, running across a porphyritic wacke [Brighton ▭, Dedham turnpike]. It, almost always, includes magnetic sulphurated iron, often crystallised in small striated cubes [Roxbury ○], and appearing constantly sensible to the magnet. It is of great tenacity, with a rough fracture. It falls into polyedrons, which sometimes present a prismatic shape. Fragments of this rock, exposed at the surface of the earth, seem more forcibly to resist decomposition, than most of the other species of amphiboloid.

*Epidotic amphiboloid* is susceptible of admitting crystals of felspar, and thus becoming *porphyritic.* Such are some fragments, found in loose pieces, particularly on the Blue Hills. This remarkable variety presents crystals of white felspar, sometimes of an inch in one dimension, accompanied by cubic sulphurated iron, and globules of laminary carbonated lime of a perfect transparency ; the diameter of these globules not exceeding three or four lines.

By comparing the green antique porphyry, with a variety of porphyritic amphiboloid, found in this country, and which includes epidote, I am induced to consider this rock, the locality of which is unknown to the moderns, as also admitting epidote in its composition, and, probably, as receiving its fine colour from this substance. I place this variety, which I have not observed in place, near the porphyritic amphiboloid, with the designation of *ophites.*

10. Sometimes amphiboloid admits quartz in its composition, *(quartzose amphiboloid)* and even appears formed entirely of amphibole and quartz. This rock is distinguished by some light veins of quartz, by a fracture somewhat conchoidal, and by its resisting, more than any other, spontaneous decomposition [Menotomy ○]. When these elements exist in fine mixture, so as to present as it were an homogeneous paste, it is hardly possible to distinguish it from *trappine amphiboloid* when found in insulated pieces [Roxbury ○, Brighton ○]. Both these rocks, when conveniently cut and smoothed, may be used as *touch-stone.*

11. I give the name *micaceous* to the amphiboloid including mica. This last mineral appears not uniformly distributed, but accidentally disseminated in some parts of common and granitic amphiboloid [Menotomy ○, Concord turnpike □]. Its most usual colour is the

yellow of tombac. Some fragments of this species, when struck by the hammer, emit a remarkable metallic sound. I will no longer insist on these two rocks, which I have not observed in masses of considerable magnitude.

12. I terminate the series of the species of amphiboloid, by that which admits talc in its composition (*Talcous amphiboloid*). This rock seems to consist entirely of black amphibole, and talc of a dark green colour, which, when the rock is fresh broken, is perceived even under the form of thin hexagonal lamina. All the parts of this rock appear sensible to the magnet, though the magnetic sulphurated iron, which exists in it, may not always be discernible.

This aggregate has neither the hardness, nor the tenacity, ascribed to amphiboloid. When exposed at the surface of the soil, it undergoes a rapid decomposition, and occurs with a spheroidal or elliptical shape, the surface of which is formed of thin, concentric strata without adhesion, involving a kernel of the some rock, which had not suffered alteration. This decomposition is similar to that of some rocks, observed in volcanic countries, and considered sometimes as lavas.

*Talcous amphiboloid* is observed forming, in *felsparoid*, a subordinate stratum, directed from northwest to southeast. [Braintree, on the Braintree and Weymouth turnpike ▭]. The surface of the stratum occurs with an appearance somewhat slaty, and some parts of it present an uniform texture, with the same hardness and colour, which indicates that this rock unites to that, which will be described under the name of *argilloid.*

### *Felsparoid.*

13. The above description spreads some light on the nature of this rock, which is distinguished from the preceding, merely by an artificial consideration. In fact, by observing it attentively we find,

that it admits occasionally, and sometimes in its whole mass, the several minerals mentioned among the species of amphiboloid.

The general aspect of this rock approaches it to the granite, from which it differs sometimes only by its geognostic situation. It predominates north of Boston, and on the south side of that place (about nine miles), where it forms an extensive ridge, which appears to be spread from the east to the west, beginning from the sea coast.

14. Felsparoid is often formed of nothing but felspar and amphibole. It then occurs principally north of Boston. The felspar in it is sometimes red-brown, but more frequently whitish, with an imperfect lamellary texture, and an aspect somewhat greasy [Chelsea □]. Sometimes white and red felspar are united in the same specimen. To this kind I give the name of *common felsparoid.*

15. This rock is more frequently found consisting of uncoloured felspar, hyaline quartz, amphibole, and sometimes small particles of talc of a light green colour. Felspar, which forms the greatest proportion, is frequently whitish, but often with a light brown or reddish brown colour. Quartz is the next in proportion; and amphibole, of a dark blue, or an imperfect black colour, exists sometimes, but in rare crystals, disseminated through the other elements. This amphibole is sometimes *attracted* by the magnet. Such is the composition of the rock, which exists in vast body at Weymouth, Braintree, and Quincy, (□) from whence it is transported to Boston for the purposes of civil constructions, particularly for making the first courses of buildings. There is a variety consisting of crystals of amphibole of a bright black colour, disseminated through white felspar of a pearly aspect. It is susceptible of a good polish, and is found beautiful on the north side of Boston [Newburyport turnpike □].

I consider also as of this species a variety of a pleasant reddish, sometimes rosy colour, which occurs commonly, not in large masses, but sometimes in powerful veins across the amphiboloid. [Menotomy □, Lexington ○]. In this rock, which I found almost always including quartz, the felspar exists in large lamina, often interrupted by layers, commonly thin, of compact epidote. Amphibole and quartz are, sometimes, in but slight proportion in this rock.

I unite the above varieties under the specific denomination of *quartzose*.

16. Epidote enters sometimes into the composition of felsparoid. Many specimens present this substance, easy to be known, distributed, in equal proportion, with felspar, quartz, and amphibole; but most frequently it is intimately united with felspar, which then assumes a more or less intense shade of green, from the usual colour of this mineral [Dedham □, Lynn □]. This species, which, according to the basis adopted for this nomenclature, takes the name of *epidotic felsparoid*, contains sometimes sulphurated iron.

17. Mica also appears among the elements of this rock, and communicates to it, in some cases, the aspect and characters ascribed to granite. Many instances of this aggregate are to be observed in several spots [Brighton □, Roxbury □, Dedham □]. The mica often exists in small scales [Newton ⊙], and frequently it occurs in plates, of an inch in diameter, and of a smoaky colour. Sometimes the rock seems a mixture of mica and felspar alone. In some cases it includes garnet, rarely tourmaline [Dorchester, Roxbury ○]; also oxydulated iron. (Magnetic iron ore, Kirwan) [Brighton □].

This species, which I call *granitic*, does not form so extensive masses, as the preceding. It is found contiguous to argilloid [Brighton □]; alternating with, or rather interposed in the middle of porphyritic wacke [Brighton □, Roxbury □].

An insulated specimen of granitic felsparoid may be taken for true granite; but geognosists agree in considering this last, which alternates with gneiss and micaceous schistus, as belonging to another order of rocks, and to another formation. Time will determine what is the value of this distinction.

18. Felsparoid presents in general no distinct stratification. It includes often veins of amorphous hyaline quartz, sometimes full of cavities, where this mineral exists with a crystalline shape. (Commonly var. prismoid). It falls most often into polyedrical fragments, the faces of which are often very smooth. Exposed to the contact of the air it moulders; and, when the felspar is in great proportion, its whole surface consists of an argillaceous crust. In a fresh state the several kinds of this rock are susceptible of a fine polish, even superior to that of granite.

When the elements of felsparoid begin to be entwined together in a confused state, so as to take the appearance of a homogeneous paste, it assumes the characters ascribed to petrosilex. [Brushhill turnpike]. When crystals of felspar remain imbedded in this uniform paste, it constitutes the porphyry about to be described among the species of petrosilex. The transition of felsparoid to petrosilex and porphyritic petrosilexis frequently observed in the compass of the present observations. [Milton □, Blue hills □, Malden □].

## *Petrosilex.*

19. Mineralogists have generally considered petrosilex as a simple mineral, and respectable authorities agree in placing it among the varieties of felspar. But if we consider, that most of the great mineral masses of the globe consist of an aggregation of distinct species; that petrosilex accompanies these rocks, and forms itself vast masses and even mountains; that among the specimens of it, which are found in nature, or seen in collections, hardly one is ever observed perfectly free of foreign substanses visible to the eye; we may entertain

some doubts on the supposed simplicity of this mineral, and endeavour to inquire from the circumstances, which accompany it in nature, whether an apparent homogeneity may not conceal an aggregation of elements (I mean of simple minerals), in a state of tenuity, which will not permit them to be perceived by our senses.

The mineralogic soil, which is now under our observation, appears well adapted to diffuse some light on this subject. Most of the different varieties of petrosilex known, being found in great plenty in this part of Massachusetts, and their intimate analogy with the *feldspath porphyre* and *klingstein porphyre* of Werner being evinced by observation, I unite them all under the general title of *petrosilex*, admitting only of two divisions, viz. *simple petrosilex* and *porphyritic petrosilex*, under which I arrange the several species and varieties, which I distinguish.

### 1. *Simple petrosilex.*

20. It exhibits an infinite variety of shades of yellowish, whitish [Quincy □, Dorchester □], greyish, greenish, brown, reddish-brown, blackish. It is sometimes found of a fine texture and semi-transparency, with a white colour, slightly tinged with green [Milton □]; sometimes with rosy spots [Chelsea ○]. I denote this kind, which strikes fire with steel, and may be confounded, to the sight, with some variety of agate-quartz, by the name of *flinty*. Sometimes the same variety presents a slight red colour, verging to the carnation [Dorchester □, Brushhill turnpike ○].

21. A variety of a greenish colour falls sometimes into tabulary fragments [Dorchester □], which become sonorous by percussion. I give to this variety or species, which is analogous to the *klingstein* of the Germans, the specific name of *sonorous*, agreeably to the opinion of some mineralogists, who consider it as a distinct mineral.

But I observe, that the property of emitting a sound somewhat metallic appears dependent in this mineral on a certain degree of cohesion, together with its tabular shape, which might be easily obtained by art from several other stones. Some thin tables of black marble are imported from the East Indies, which are used in China instead of bells; and even ice itself possesses the same sonorousness, when in large plates and condensed by a great degree of frost. Some fragments of sonorous petrosilex are found interrupted by veins of compact epidote.

22. I give the name of *jasper-petrosilex* to a species, which presents a red brown or dark red colour, with but very little translucency on the edges. This kind, fusible before the blowpipe, sometimes into a white enamel, often presents several veins of different shades of reddish [Malden ⌑]; sometimes white and red veins, running parallel to each other, in straight or curved lines [Chelsea beach ○]. Most of the varieties of jasper petrosilex are susceptible of an high polish.

From the likeness of the *veined* jasper-petrosilex with some stones, which were used by the ancient Greeks and Romans in making basso-relievos, called camehuja, we are induced to admit, that most of the stones, called antique engraved stones, consist of a mineral of this kind. An ingenious naturalist has before observed, that the jasper, veined red and green from Siberia, was a petrosilex.

Some fragments of jasper-petrosilex include often spots of a flesh colour [Milton ⌑], perfectly analogous to the petrosilex of Carlshakt in Sweden.

23. Petrosilex of a homogeneous texture and a middling hardness, when smoothed conveniently, is susceptible of being used as whetstone. Some is found exactly analogous to the Turkey-stone, which, as Bened. de Saussure first observed, ought to be considered as belonging to this genus. It is probable that this part of Massachusetts

could supply the whole United States with this kind of mineral, which is sold at a pretty high price in commerce. To this species I attach the name *novacular.*

24. The naked eye, and still better the magnifying glass, discovers, in almost all the above described species of petrosilex, small particles of simple minerals; such as quartz, epidote, amphibole, small crystals of felspar, arsenical and simple sulphurated iron, &c. The grains of quartz appear particularly abundant, when it adjoins to the wacke. A variety is observed [Brushhill turnpike,] which falls into pieces, the faces of which are coated with dendrites of black manganese, which is rendered very apparent by the almost white field of the stone.

Simple petrosilex abounds principally on the north and south of Boston, where it sometimes forms hills. It is observed contiguous to wacke and felsparoid, where it appears confounding itself with these two rocks. [Quincy ○, Malden □, Dorchester □, Dedham □].

### 2. *Porphyritic petrosilex.*

25. Most of the petrosilex above mentioned [Quincy □, Dorchester □], presenting some chrystals of felspar scattered in a whitish or brownish cement, might be considered as porphyries; but, agreeably to the common meaning we shall restrict this term to the kind, which presents crystals of felspar in a notable proportion, cemented by a petrosiliceous substance, commonly of a dark colour, as reddish, brown-red, greenish, black, &c.

26. The reddish brown variety, with white felspar, is the most abundant. It forms vast masses [Malden □, Lynn □], contiguous to felsparoid and jasper petrosilex, which evidently constitute its cement. Some fragments of considerable bulk are found, of a deep red

color, and equal in beauty to the best antique prophyry [Chelsea ○, Lynn ○]. This variety sometimes contains crystals of amphibole, and some particles of a deep green colour, which seem to belong to epidote.

27. Some loose fragments of porphyritic petrosilex are found of a greenish and black colour [Chelsea ○, Islands of the harbour ○]. This last, which presents white shining crystals of felspar, appears analogous to the black porphyry of the ancients, porfido nero of the Italians. Perhaps it is but a variety of porphyritic amphiboloid. A variety is found in the northern part of the Blue hills, presenting small crystals of a light red colour, cemented by a dark brown petrosilex, fusible into a black enamel. It is observed running across the main rock of this part of the country.*

28. The surface of petrosilex, simple and porphyritic, exposed to the contact of the air, moulders, and presents almost always an earthy crust, sometimes adhering to the tongue. In its primitive state, however, this rock is commonly so hard as to sparkle with steel, and then it is susceptible of a high polish. This polish protects it against de-

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* The Blue hills are in Milton, about ten miles south from Boston, and are the highest ground in this part of Massachusetts. From the most elevated, as from an observatory, an extensive portion of this picturesque country is presented to the view. They appear to consist of felsparoid, verging to petrosilex, simple and porphyritic. This rock is often interrupted by powerful veins of quartz, full of cavities, coated with small crystals of the same substance, some particles of oligist iron, and signs of carbonated iron (brown spar).

The observations, made in this part, are common to the Hon. Judge Davis, Messrs. Joseph Tilden, Richard Webster, T. Capt, and Charles Davis. I hope these gentlemen may give more extent to the yet imperfect description of those interesting heights.

composition, generally arising from the contact of water, which has less adherence to a smooth than to a rough surface. Hence some of the ancient porphyries, which were, so many centuries past, transported from Asia to Greece, and from Greece to Italy, are still found among the ruins of this last country, sometimes in an unaltered state.

### *Argilloid.*

29. The transitive point, which forms the limit between this rock and petrosilex, is very uncertain; and these two rocks are often found uniting themselves in the same spot [Dorchester □, Milton □]. It is highly probable they are formed of the same constituent parts, only with less cohesion in the argilloid. A property, which seems characteristic of this rock, is its tendency, when it exists in large body, to fall into thin plates; whence the vulgar name of slate commonly given to this mineral.

Its common colour is grey, [Roxbury Ⅱ, Brighton □], greenish [Newton Ⅱ], blackish [Weymouth Ⅱ, Governor's island Ⅱ]; also brown, reddish brown [Malden Ⅱ, Dorchester □]. A variety is found presenting thin white strata, in alternate order with brown red ones [Dorchester Ⅱ]. This last kind has the property of being used as whetstone, and may replace the Turkey-stone. The mineral, of both colours, has the same property.

I distinguish only two species in this rock,—the *common argilloid*, the most common kind, found in Brighton, Newton, Roxbury; and the *novacular*, that which may be used as *whetstone*.

30. This mineral often includes sulphurated iron; some fragments are found presenting veins of compact epidote, or compact carbonated lime; and others exhibit little fissures, in which a multitude

of small scales of green talc are perceived [Dorchester]. Perhaps the colour, often greenish, of this mineral, arises from the substance of talc disseminated in its mass; this colour appearing, in fact, the same with that, which would result from the mixture of a green powdered talc with a white body, such as chalk or white clay.

The property of argilloid, of being adapted to sharpen instruments of steel, that is, to produce the effect of a file, whilst it is soft enough to be cut with a knife, indicates, that it is formed of an aggregation of substances, different in their nature, notwithstanding its apparent simplicity; and we are induced to admit that one of those substances is silica in the state of quartz.

31. The observations of several chemists having ascertained the presence of fixed alkalies in several rocks of Europe, and Klaproth, in particular, having found soda in the klingstein (analogous to our sonorous petrosilex), I was desirous to verify these observations in a mineral of America. The specimen I selected was of the hardest kind of argilloid, very much like sonorous petrosilex. Its specific gravity was 2.746. Its surface was covered with a light white crust. It was taken at Roxbury, about seven miles from Boston, not far from the line, which separates this town from Dorchester.

### *Chemical examination of argilloid.*

32. One hundred parts of this mineral (600 grains), reduced to a subtile powder, were mixed with equal parts of concentrated sulphuric acid. The mineral having been previously warmed, the mixture acquired a degree of cohesion nearly equal to the former hardness of the stone. Exposed for some time (about 15 days) to the open air, cautiously defended from the access of foreign bodies, the mixture

grew softer, and the supernatant liquor appeared of a yellow colour, indicating that the mineral had been attacked.

The part remaining solid of this mineral was separated from the liquid. Well washed and dried, it weighed 85 parts; its loss was consequently 15. Its colour was not much altered.

The solution presented a deep yellow colour. United to the water of lixiviation, and submitted to evaporation till dryness, it abandoned a precipitate consisting of sulphat of lime, which, when dry, weighed 17,058 (effective lime 5,50).

A new quantity of water being added to dilute the remaining salts, this solution, again submitted to evaporation, when concentrated, gave a light precipitate with a concentrated solution of muriat of platina, and some traces of alum. This proves the presence of potash.

Ammonia in excess poured into this solution, occasioned a floccous precipitate of a yellowish brown colour, consisting of alumina and the oxyds of manganese and iron. Calcined in a crucible, it weighed 6,075.

The liquid, separated from this last precipitate, was submitted to desiccation, and the sulphat of ammonia, vapourised in a crucible of platina, a fixed saline substance remained, weighing nine grains. This substance, diluted in water, and abandoned to crystallization, presented a mixture of two salts well characterized sulphat of potash, and sulphat of soda.

The difficulty of an exact separation of these two salts in so small a bulk, and the uncertainty of the proportions of the component parts the sulphat of soda, which arises from the great proportion of water it absorbs and loses by exposure to air and calcination, do not permit a rigorous estimation of the quantity of each alkali. From the proportion of sulphat of potash rated at two-thirds of the saline mixture, and according to the basis taken from Bergman, the quantity of alkali has been valued at 2,50 grains for the potash, and 0,90 for the soda; or 0,41 parts potash, and 0,11 soda, of the original weight of the mineral employed.

In uniting the above results, we may admit that argilloid has given, in the fifteen hundredth parts diluted by sulphuric acid,

| | |
|---|---|
| Lime . . . . . . . . | 5,50 |
| Alumina, stained by the oxyds of iron and manganese, | 6,75 |
| Potash, . . . . . . . . | ,41 |
| Soda, . . . . . . . . . | ,11 |
| Loss, consisting of water and carbonic acid, . . | 2,23 |
| | 15 |

The proportion of silica existing in argillaceous schistus, petrosilex, &c. being ascertained, by many analyses, never less than 55, if we suppose, that those parts beyond 55, which had not been attacked by the acid, contain a quantity of the other substances proportional to that above mentioned, we may calculate, on an average, at about *one hundredth*, the proportion of alkali contained in the argilloid submitted to this examination.

This analysis, to which the situation of a traveller did not permit me to give a greater degree of accuracy, is sufficient to establish the important fact of the existence of potash and soda as elements in some rocks in this part of the world.

Klaproth, in his analysis of the klingstein of Dounerlberg, a mountain in Bohemia, supposes the quantity of soda contained in this mineral to be a twelfth. The result of the present observations differs from that of this celebrated chemist. But if we consider the petrosilex and argilloid as aggregates, we shall not be surprised to find so great a variety in the results of the analyses of these minerals, though placed under the same title.

### *Wacke.*

33. One of the predominant rocks of the country, and undoubtedly the most remarkable, is that bordering upon Boston in a south direction, which appears to spread itself from northwest to southeast, and which is observed, in full display, principally in the towns of Brighton, Brookline, Roxbury, Milton, and Dorchester, when it disappears under the sea.

This rock, denoted in the country by the name of plum pudding stone, is formed of conglutinated kernels, of different sizes, colour, and nature. The most apparent are,

1. Quartz, mostly opaque, compact or granulated, of a great diversity of colours (whitish, blueish, greenish, reddish, of different degrees of intensity), sometimes with the aspect of petrosilex (but without fusibility), and presenting, now and then, some small bright crystals of felspar.

2. Petrosilex and argilloid, variously coloured (greyish, blueish, reddish, 20 & 29). When the fragments of these two are predominant, the rock presents the aspect of breccia, sometimes analogous to the diaspro breciato of the Italians, antique breccia.

3. Nodules, consisting of grains of whitish, greyish or reddish

laminary felspar, often with an aspect somewhat greasy; grains of hyaline quartz, commonly uncoloured; small particles of amphibole; and sometimes a green substance, which is epidote.

4. Nodules of petrosilex involving small crystals of felspar, and sometimes grains of quartz, and presenting a perfect analogy with some porphyritic petrosilex above mentioned (25); whence I have drawn the specific name of *porphyritic.*

34. The nodules or kernels, which compose this rock, have sometimes more than a foot diameter [Brookline], with almost always an orbicular or elliptical figure. Those, which present a polyedrical form, have their angles commonly rounded. These nodules are closely fitted and joined together, without leaving any empty spaces. They are not united by a cement; for, notwitstanding the aspect of some varieties of this rock, the naked eye may observe, that the spaces which exist between these kernels, are filled, not with an homogeneous paste, but with small comminuted fragments of minerals of the same nature as the large one. Sometimes the kernels present an uniform and progressive size, down to that of sand stone, and from these this rock, in an insulated specimen, may be confounded with a free stone. I give to it the designation of *granulated.*

35. The surface of this rock, in contact with the air, is soon altered. The felspathic and petrosiliceous parts moulder into clay, and the quartzose nodules, with commonly a rough surface, remain in projecture, or come off, leaving empty the cells, in which they were included.

It falls commonly into vast polyedrons, the faces of which are sometimes smooth, as if they had been polished by the friction of a stream of water.

This rock often contains veins, sometimes very thin, of white hyaline quartz, carbonated lime-and-iron, (brown spar), rarely of compact epidote. Epidotic amphiboloid, felsparoid, argilloid, and amigdaloid form subordinate masses to it, or rather are interposed in the great masses of this rock. It is found contiguous to amygdaloid [Brighton]; the joining line being interrupted with large lumps of quartz, accompanied by chlorite talc, pyritous copper, and olygist iron.

36. How much attention soever I have paid to the examination of this rock *in situ*, I have never observed in it any distinct stratification. It commonly unites with the rocks previously described, and with amygdaloid, often by an insensible transition. I possess specimens, which, on pieces of four inches square each, present its different passages to felsparoid, amphiboloid, simple and porphyritic petrosilex, argilloid, &c.

On account of the difficulty of giving to this rock a name, taken from its nature, I have been induced to adopt the name of *wacke* used by the German mineralogists, who have observed this rock better than others. It corresponds to the brecia saxosa of Crousted, and to the rock of Vallorsine (pudding of Vallorsine) of Saussure. When unaltered, it is susceptible of an high polish.

37. An examination of the nature of this rock, together with its geognostic situation, concur in inducing us to consider it as belonging to primordial soil. In fact, the freshness of the substances, which form the elements of its kernels, when the internal part of it is opened, and their rapid decomposition, when in contact with air and water, prevent the supposition, that it has been formed by a union of the fragments of primordial rocks, rounded by friction, transported and deposited by waters, and joined or soldered together by a secondary operation; a supposition, which has been adopted to explain the origin of the pudding stone and sand stone, which belong to seconda-

ry soil. Besides, its bordering upon rocks considered as primordial, to which it unites by insensible transitions, and which it sometimes includes, confirms that it has a common origin with them.

If permitted to venture an opinion on the mode of its formation, we may suppose, that, as we find in it specimens of almost all the rocks, which predominate in the country, it originated from a motion, which disturbed and divided the vast deposits of felspathic, porphyritic, petrosiliceous, &c. rocks, while they were passing from the state of fluidity to that of solidity. This motion ought to be supposed as having taken place, before the complete solidification of these rocks; since the compactness of the wacke indicates that its elements were in a state of softness, which permitted the union of these heterogeneous bodies to form a solid mass. Moreover this aggregation cannot be supposed to have been formed after the last cast of the primordial deposit, because the rents, which took place in its mass, have been filled by veins or rather strata of amphiboloid and felsparoid (some specimens of this last entirely resembling granite), which demonstrates, that these minerals were still depositing themselves, at a period later than the formation of the wacke. After all, I give to this explanation respecting the formation of this rock, only the value it will receive from naturalists themselves; persuaded, that the destiny of all theories respecting geological facts is to remain hypothetical, until the surface of the earth shall be more attentively and more generally observed.

## *Amygdaloid.*

38. This rock is the least abundant. I had an opportunity of examining it only in one place [Brighton ▭]; but several fragments, scattered in many parts, indicate that it exists in other spots.

It consists, most frequently, of rounded or irregular nodules, composed of quartz, felspar, laminary carbonated lime, epidote, and sometimes chlorite talc. These substances often exist in insulated concretions; but, sometimes, two or three are united in the same nodule. Some of them, consisting of quartz, appear as if enchased in the substance of epidote; some others present a cavity in their centre, the surface of which is coated with microscopic crystals of quartz and epidote.

The cement, apparently homogeneous, which unites these globules, is commonly reddish brown, sometimes verging to greenish. It often contains particles of a blood-red coloured substance, which seems of the same nature as the jasper petrosilex (22.); some spots of carbonated copper; and now and then, crystals of amphibole and chlorite talc. Sometimes it contains veins of felspar, lamellated or almost compact; sometimes of quartz, accompanied by thin lamina of oligist iron, carbonated copper, pyritous copper in small particles, and chlorite talc. This rock is found contiguous to felsparoid, epidotic amphiboloid, and porphyritic wacke, on which it is observed resting [Brighton ▭]. Sometimes it occurs with a schistous texture, and even emits an argillaceous smell, when breathed on.

This rock is analogous to the toadstone of the English. When of great compactness, it is susceptible of a fine polish.

## *Conclusion.*

I present the description of this series of rocks, which evidently belongs to primordial soil, without any hypothesis on the comparative order of its formation. In the course of my observations, in this and other countries of America, which appear remarkably well suited for geognostic investigations, I never had an opportunity of verifying that arrangement of superposition in primordial rocks, from which is inferred the order of antiquity, supposed by some systems introduced in Europe.

A peculiar interest in the study of this part of America arises from the relation, which exists between its rocks and those, which were in great repute among the people of Asia, Greece, and Italy. A view of the table, which accompanies this memoir, will indicate that it includes almost every stone, which had celebrity among those nations. We may therefore infer, that a description of this part of Massachusetts would agree with the place, now unknown, where the Greeks and Romans procured those articles, which their luxury has transmitted to the moderns.

With respect to social utility, we observe, that metals, which form so extensive a part of the national riches of a country, appear by no means abundant in this soil. Iron and copper in particular, so plentifully distributed in other parts of America, are quoted here merely as mineralogical notes. But some other substances, found here, and neglected as useless, may be employed in society ; one mineral, which may replace the turkey stone ; another, which may be used in painting ; a set of rocks, susceptible of an high polish, fit for elegant ornaments, whose hardness and durability may render them useful for many other purposes, and which may even form articles of export, when some process of cutting and polishing them in a large and cheap way shall be found, &c.

I conclude here the account of those minerals, which recal to my mind the pleasant moments I have spent in this part of America. I hope their description may have some interest for the respectable citizens of New England, from whom particularly I have received so many marks of benevolence and friendship. It always will be a great satisfaction for me to remember, that I reckon some friends among those, that present the fair example of a people, who know how to advance in civilization, and preserve the respect for morals and domestic order, which distinguished their ancestors; and who appear still worthy of the high destinies, which await the American people.